Taking It To The Next Level - The AO Process and Mission Design and Implementation

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By
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Abstract

NASA has made tremendous strides to develop science mission programs that can be supported by Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), including Hispanic Serving Institutions and Tribal Colleges and Universities. The University Explorer (UNEX) and University Earth System Science (UnESS) programs are designed for that specific purpose. However, participation in these programs by HBCU institutions at the Principal Investigator/Co-Investigator level has been sparse, at best. There is a tremendous science and engineering capability that exits among HBCU member institutions. This is evident in the successful implementation of the MURED research grants program and the MU-SPIN university information systems and technology infrastructure assistance program. HBCU, OMU, and TCU administrators will need decide if their institutions will strategically pursue NASA Announcements of Opportunity mission solicitations as Principal and/or Co-investigators. Through requisite training, coaching, and partnering, HBCUs can develop responsive proposals to manage and implement a major NASA science mission.

MURED and MU-SPIN

NASA's Office of Equal Opportunity Programs (Code E) established the Minority University Research and Education Division (MURED) in 1990 to increase the Agency's responsiveness to Federal mandates related to Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), including Hispanic Serving Institutions and Tribal Colleges and Universities. MURED is responsible for formulating and executing the Agency's Minority University Research and Education Program (MUREP) budget of which a $60 million investment in research grants were awarded to HBCU's representing a 14.4 percent increase over the Agency's expected FY 1999 investment. Forty-five HBCUs received 209 awards that reached more than 36,000 faculty, administrators, and students.

The Minority University Space Interdisciplinary Network (MU-SPIN) primary focus is on the transfer of advanced computer networking technologies to HBCUs, TCUs, and OMUs and their use for supporting multi-disciplinary research. By leveraging the success of these programs, HBCU institutions can began to access their ability to pursue NASA earth and space science missions.

Research Sponsoring Organizations

There exists several primary NASA research sponsoring organizations. They include:

- Minority University Research and Education Division
- NASA Institute for Advanced Concepts
- Office of Earth Science
- Office of Life and Microgravity Sciences
- Office of Space Science
- Small Business, University, and non-profit Research Institution
- Technology Innovation and Research Programs (SBIR/STTR)

Each of the above research sponsoring organizations has in its strategic goals to direct opportunities to HBCU, OMU, and TCU institutions. NASA has made tremendous strides to accomplish that goal.

University Explorer Missions

The NASA GSFC University Class Projects Office, Code 850, Explorer Program, Space physics and astronomy missions, is intended to examine the Earth space environment and to observe the universe beyond Earth. Additional information concerning the Explorer Program can be found on the web at http://www.hq.nasa.gov/office/oss/. The primary focus for the Explorer Program is:

- Astronomical Search for Origins and Planetary Systems;
- The Sun-Earth Connection; and
- Structure and Evolution of the Universe

The Explorer program consist of four classes of missions that include:

- University Explorer (UNEX) - not to exceed $13 million
- Small Explorer (SMEX) - not to exceed $71 million
- Mid-Explorer (MIDEX) - not to exceed $140 million

- Missions of Opportunity - participate in a non-NASA space mission of any size, but having a NASA cost under $21 million

The UNEX is specifically designed for university managed missions. It is intended to provide frequent flight opportunities for highly focused and relatively inexpensive science missions. UNEX investigations must be either a complete mission or a secondary payload on a spacecraft. The total cost to NASA is limited to $13 million (FY98) and is managed by GSFC for Office of Space Science.

The Office of Equal Opportunity Programs will consider providing capital investment funding to enhance the capacity of HBCU's and OMU's on successful proposing teams to carry out their mission responsibilities. This investment will provide infrastructure germane to the proposed University-class Explorer mission and will have long-term benefit to the HBCU/OMU.

The GSFC University Class Projects Office, Code 850, University Earth System Science Project (UnESS), is designed to provide for significant and meaningful "hands-on" student involvement. These investigations are capped at $15M in NASA Earth Science Enterprise funding. Participation of HBCU and OMU including Hispanic serving institutions or Tribal colleges and universities is being strongly encouraged. Thew UnESS web site can be found at http://www.wff.nasa.gov/~code850/pages/uness.html

A Mission Perspective

Principal Investigators (PIs) are solicited through a continuing NASA Announcement of Opportunity (AO) process in which the PI proposals constitute the first cycle of formulation. The PI is responsible to NASA for the scientific integrity of the mission, as well as the management of the complete mission including the:

- Instrument
- Spacecraft
- Launch Vehicle
- Ground System
- Data Collection and Distribution

The PI has responsibility and authority for the entire life cycle of the mission as well as the mission's program cost, schedule, and technical performance and the management of system requirements. The PI should be knowledgeable in all these areas and call on experts to assist or as a team member. The phases of the mission life cycle include:

Phase 1: Mission Concept Studies

Phase 2: Mission Definition and Preliminary Design

Phase 3: Mission Detailed Design

Phase 4: Mission Development and Launch

Phase 5: Mission Operations and Data Analysis, Archival, and Dissemination

NASA uses the AO process to solicit earth and space science mission proposals from the science community. The goal of the AO Process is somewhat different than that of the NASA Research Announcement (NRA). These differences are reflected in the table below.

Space Mission AO	NASA Research Announcement
• The PI is responsible to NASA for the scientific integrity of the mission, as well as the management of the complete mission • Generally solicits end-to-end investigations, which begins with concept definition, includes spaceflight hardware development, and ends with delivery of the data products to the scientific community • Typically capped at $15 million (UnESS) to $13 million (UNEX). • Once selected for flight, failure to maintain reasonable progress on an agreed upon schedule or failure to operate within the constraints outlined in the AO may be cause for termination by NASA • Proposals go through a screening process. Selected proposers will conduct concept studies, culminating in the Concept Study Report, which will be used as the basis for the Downselect Process	• The PI is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. For some targeted solicitations (MURED), cannot exceed a designated funding level over a determined period of time. • NASA does not have mandatory forms or formats for responses to NRAs • Up to $250K. MURED PI awards capped at $100K for three years. • MURED solicitations targeting the HBCU, OMU, and TU communities

NASA will evaluate how well the proposal satisfies the requirements of the AO, even for those aspects of the mission contributed by mission partners other than NASA. The proposals must be compliant and compelling, demonstrate the ability to do what you say you can do, and demonstrate real scientific "value" in the approach.

Building a Capability

Each HBCU institution must decide if it has in its strategic plan the pursuit of NASA missions. This must be something the institution desires to do and has the passion to pursue. The institution has to be willing to make the "long term" investment. This capability may take several years to develop. An approach would be to leverage the success of MURED/MU-SPIN programs and successful implementations of research grants from other sources. The institution must develop teaming/collaborations (Co-Investigator) to leverage technical and/or scientific strengths of partners.

Setting Goals

To begin building a capability, the institution must determine if pursuing earth and space science missions is a goal of the institution. If it is a goal, the following should be addressed:

- Assess your technical, scientific, engineering, and management strengths and weaknesses
- Identify individuals you believe have the ability and passion to pursue a NASA mission.
- Develop a plan to attract capable scientist and engineers to the institution (if athletic departments can do it, why can't the sciences and engineering)
- Attend scientific colloquiums and conferences where earth and space science issues are being discussed. This is an excellent opportunity to network
- Make it known to majority institutions that you are interested in forming collaborations. Begin to develop partnerships/consortiums with these institutions

Industry Participation

NASA should consider using an experienced systems and mission engineering industry partner to provide the necessary support to assist in developing PIs at HBCUs. The goal of the industry partner would be to coordinate and bring to bear existing NASA resources to implement the necessary training. The training would involve classroom instruction, GSFC mission design review observations, and case studies of successful earth and space science AOs and NRAs. PI candidates would be required to devote a predetermined number of hours in each area. Each member institution would be required to provide some amount funding for the participation of their representative(s) in this initiative. The industry partner would provide instruction on developing compliant and compelling proposals. The training initiative would be promoted through an aggressive outreach and awareness program leveraging existing programs and possible resources (MURED, MU-SPIN, University Grants, etc.).

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